

CLAIMS

What is claimed is:

1. A method of forming an epitaxial silicon-containing layer on a silicon germanium surface, said method comprising:
 - performing an ex-situ chemical oxide removal process on said silicon germanium surface so as to partially remove oxygen from said silicon germanium surface and leave a first amount of oxygen on said silicon germanium surface;
 - heating said silicon germanium surface sufficiently to remove additional oxygen from said silicon germanium surface and leave a second amount of oxygen, less than said first amount, on said silicon germanium surface; and
 - epitaxially growing said epitaxial silicon-containing layer on said silicon germanium surface.
2. The method in claim 1, wherein said ex-situ chemical oxide removal and heating processes increase the roughness of said silicon germanium surface by less than 1 Å RMS.
3. The method in claim 1, wherein said silicon-containing layer comprises one of Si, $\text{Si}_x\text{Ge}_{1-x}$, $\text{Si}_x\text{C}_{1-x}$, and $\text{Si}_x\text{Ge}_y\text{C}_{1-x-y}$.
4. The method in claim 1, wherein said ex-situ chemical oxide removal comprises a hydrofluoric acid etch.
5. The method in claim 4, where said hydrofluoric acid comprises a $\text{H}_2\text{O}:\text{HF}$ solution with ratio of 10:1 to 500:1.

6. The method in claim 1, wherein said first amount of oxygen is less than $1 \times 10^{15}/\text{cm}^2$.
7. The method in claim 1, wherein said second amount of oxygen is at least $5 \times 10^{12}/\text{cm}^2$.
8. The method in claim 1, wherein said second amount of oxygen is between approximately $1 \times 10^{13}/\text{cm}^2$ and approximately $5 \times 10^{13}/\text{cm}^2$.
9. The method in claim 1, wherein said heating process is performed in a hydrogen-containing ambient.
10. A method of forming an epitaxial silicon-containing layer on a silicon surface, said method comprising:
 - performing an ex-situ chemical oxide removal process on said silicon surface so as to partially remove oxygen from said silicon surface and leave a first amount of oxygen on said silicon surface;
 - heating said silicon surface sufficiently to remove additional oxygen from said silicon surface and leave a second amount of oxygen, less than said first amount, on said silicon surface;
 - and
 - epitaxially growing said epitaxial silicon-containing layer on said silicon surface.
11. The method in claim 10, wherein said silicon surface comprises one of a patterned strained silicon surface and a patterned thin silicon-on-insulator (SOI) surface.
12. The method in claim 10, wherein said ex-situ chemical oxide removal and heating processes increase the roughness of said silicon surface by less than 1 \AA RMS.
13. The method in claim 10, wherein said silicon-containing layer comprises one of Si, $\text{Si}_x\text{Ge}_{1-x}$, $\text{Si}_x\text{C}_{1-x}$, and $\text{Si}_x\text{Ge}_y\text{C}_{1-x-y}$.

14. The method in claim 10, wherein said ex-situ chemical oxide removal comprises a hydrofluoric acid etch.
15. The method in claim 14, where said hydrofluoric acid comprises a $\text{H}_2\text{O}:\text{HF}$ solution with ratio of 10:1 to 500:1.
16. The method in claim 10, wherein said first amount of oxygen is less than $1 \times 10^{15}/\text{cm}^2$.
17. The method in claim 10, wherein said second amount of oxygen is at least $5 \times 10^{12}/\text{cm}^2$.
18. The method in claim 10, wherein said second amount of oxygen is between approximately $1 \times 10^{13}/\text{cm}^2$ and approximately $5 \times 10^{13}/\text{cm}^2$.
19. The method in claim 10, wherein said heating process is performed in a hydrogen-containing ambient.
20. A method of forming an epitaxial silicon-containing layer on a silicon surface, wherein said silicon surface comprises one of a patterned strained silicon surface and a patterned thin silicon-on-insulator (SOI) surface, said method comprising:
- performing an ex-situ chemical oxide removal process on said silicon surface so as to partially remove oxygen from said silicon surface and leave a first amount of oxygen on said silicon surface;
 - heating said silicon surface sufficiently to remove additional oxygen from said silicon surface and leave a second amount of oxygen, less than said first amount, on said silicon surface;
 - and
 - epitaxially growing said epitaxial silicon-containing layer on said silicon surface.